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The Honorable E. Scott Pruitt, Administrator
United States Environmental Protection Agency
1200 Pennsylvania Avenue, NW
Washington DC 20460

Dear Administrator Pruitt:

The Environmental Financial Advisory Board (EFAB) is pleased to present you with our report on Financing Strategies for Domestic Recycling Programs. In this report, we present our analysis and observations on this important nationwide matter.

EPA's Office of Land and Emergency Management (OLEM) requested that the EFAB benchmark the financing mechanisms in use today and identify financing strategies for recycling infrastructure that are more sustainable and resilient to market volatility (emphasis added).

To address this charge, we analyzed this matter both within EFAB as well as with outside expert consultants. Our report is structured in three parts. In the first part, we outline the study charge and describe different types of financing initiatives. In the second part, we articulate the current challenges in the domestic recycling market, many of which do not have easily identified solutions. The third part of the report provides examples of different organizational/financing/technical/regulatory/social approaches that successfully divert materials from landfills.

In discussing our findings and observations with OLEM, all parties agreed that there are no "financial silver bullet" solutions to addressing market volatility as it pertains to recycling efforts. We also conclude that absent a shift in consumer/residential behaviors regarding the desire for recycling efforts and programs or a shift in environmental policy and regulatory efforts that redirect both individual and community behaviors, the lowest cost materials management solutions (i.e. landfilling) will be difficult to overcome in many areas of the country. Consumer behavior, as it pertains to recycling, is heavily driven by individual core values and priorities. In other words, "I recycle because it's the responsible thing to do."

It is our collective opinion that culture/core values and priorities/desire may provide a basis to overcome the economic challenges faced by the various commodities, as well as the common challenge that it is "easy/cheap to throw things away". A regulatory approach that considers the overall life cycle and social costs of waste management options and which is tied to flexible recycling revenues (or costs to the residential service user) will often be an effective method of increasing program effectiveness.

We hope that you find our review, observations and specific examples valuable to EPA and we thank you for the opportunity to assist you with this charge.

Sincerely,

A handwritten signature in black ink, appearing to read "Tom Liu", with a long horizontal flourish extending to the right.

Thomas Liu, Interim Chair
Environmental Financial Advisory Board

Enclosure

cc: Mr. Barry Breen, Acting Assistant Administrator
Office of Land & Emergency Management

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Financing Strategies for Domestic Recycling Programs

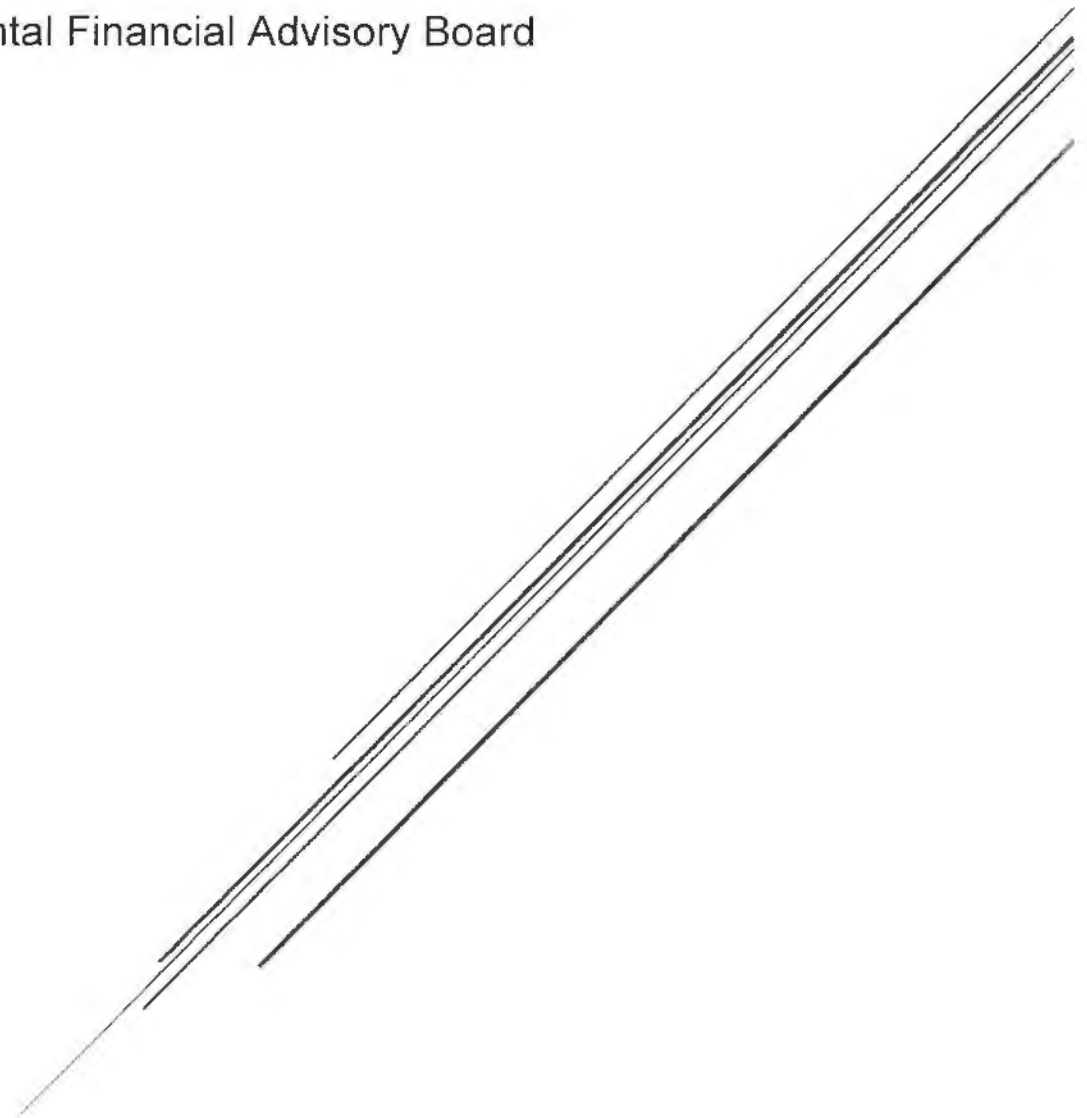
December 2017

This report has not been reviewed for approval by the U.S. Environmental Protection Agency; and hence, the views and opinions expressed in the report do not necessarily represent those of the Agency or any other agencies in the Federal Government.

Printed on Recycled Paper

FINANCING STRATEGIES FOR DOMESTIC RECYCLING PROGRAMS: EPA CHARGE AND EFAB REPORT

Environmental Financial Advisory Board



December 2017

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EPA's Charge

EPA's Office of Land and Emergency Management has requested that the Environmental Financial Advisory Board (EFAB) benchmark the financing mechanisms in use today and identify financing strategies for recycling infrastructure that are more sustainable and resilient to market volatility (emphasis added). Specifically, EFAB was directed to focus on strategies for domestic recycling programs and infrastructure that can address the high volume and variety of materials entering waste streams.

EPA raised specific questions on residential/consumer behaviors and materials recovery at the municipal level:

- Can co-funding arrangements and credit mechanisms be designed that will better handle market volatility and distribute risk among recycling stakeholders, including the facilities themselves, municipal governments, manufacturers, and the public?
- How will communities and service providers raise the capital needed to modernize their technology to adapt to changing conditions?
- Can financial incentives be created/used to develop markets for recycled materials that are closer to recycling sites?
- Can recycling infrastructure be developed that simultaneously maximizes the types of materials able to be processed and the ease with which the public can use the system, while maintaining profitability?
- How can recycling infrastructure and business models be built to serve the material recovery needs of today, but also to be able to adjust to material changes over time?
- Can recyclers/processors connect with packaging designers to ensure that recyclers' needs are accounted for in the design of new products and that recyclers are being given sufficient lead time to prepare for processing new types of materials?

EPA staff requested input on mechanisms that involve public infrastructure funding programs, products private banks can consider making available to their customers, partnership options that may include public, private and or non-profits, municipal bonds and other ideas that would provide financing mechanisms in states, counties, underlying municipalities and communities for recycling infrastructure.

Background

Over the past several years, collapsing and fluctuating commodities prices have undercut recycling and waste processing companies' ability to remain profitable while processing the low-market value, high-volume materials that come through their facilities, such as corrugated cardboard, glass, and paper. According to data provided by Sound Research Management Group, Inc., the revenue per ton generated for curbside recycled materials in 2016 has fallen at least 40 percent from a fifteen year high. At the same time, large amounts of materials are landfilled every year and we pay to do so. Given the negative impacts of landfilling that accrue to society as a whole, there likely is a need to consider federal or state (or both) regulatory or policy changes that will mandate recycling and waste reduction actions. Policy and regulations are essential tools for dealing with situations such as waste management where there are many "externalities" that impact individuals and communities outside of those making the decision whether to landfill or not. Regulation also has the added result of supporting the concept "that necessity is the mother of all inventions or improvements". However, regulatory or policy changes were determined to be beyond the scope of this charge.

Circular economy opportunities exist for a variety of materials recovered/recycled from domestic sources including metals, plastics, and fabrics. Electronics parts can be recovered and reprocessed, as can battery components. Plastics can be shredded into small particles and reprocessed. Fabrics can have extended product lives.

The disposal of otherwise recyclable materials remains a major environmental and economic issue in the United States: materials management across the entire life cycle of products, from design to disposal, accounts for 42 percent of all U.S. greenhouse gas emissions. The disposal of recyclables, and its impact on both landfill management and commodity prices, is beyond the scope of this charge. Our observations, however, is that extensive and continual education of the public is needed. Grant funding could be a viable path to provide community-level education resulting in an indirect mechanism for increasing revenue from recovered materials.

EPA's report *Advancing Sustainable Materials Management: Facts and Figures 2013* estimated that product packaging (including cardboard, glass, aluminum, and plastic) made up the largest portion of municipal solid waste (MSW) generated in 2013 - more than 75 million tons, or 29.8 percent of all MSW. Although glass is typically viewed by households as being recyclable, in fact it is commonly ground up and used for daily cover material at municipal landfills rather than being used for an alternative raw material. At present, only 51 percent of the packaging waste being generated is being recycled, most of which is cardboard. Infrastructure, access, and education for the recycling of plastic, glass, and metal in particular remain severely underdeveloped.

Recycling effectiveness depends on multiple elements: curbside or centralized pickup; single or multiple stream segregation at the pickup location; local processing facilities for materials that cannot bear the cost burden of transportation; and markets for recovered materials. Like many

other types of environmental programs, recycling programs are underdeveloped in rural areas, poorer communities, and tribal territories. More than half of the U.S. communities have access to curbside recycling programs (which means that almost half of them do not), but individual participation in those programs averages less than 50 percent.

EPA's Sustainable Materials Management program is currently developing a focused effort to address materials waste and sustainability. Many of the recycling facilities and business models were developed based on a market landscape that has undergone significant changes. EPA has found that the types and volumes of materials entering materials recovery facilities (MRFs) is changing almost as rapidly as the facilities themselves. For example, ten years ago flexible film packaging material (mostly used for foods) comprised less than one percent of the packaging waste stream; today, flexible film represents nearly 18 percent of all packaging waste. At the same time, single stream recycling has become an important factor in the dramatic uptick in the volume of material being recycled but also possibly a significant contributor to the decrease in the profitability of recycling as contamination accentuates the problem of falling commodities prices. Collection and processing costs per aggregate ton have gone up and revenues per ton have declined. This challenging trend has stressed, if not broken, many existing recycling business models.

There are multiple recycling focused organizations working on promoting and enhancing recycling (but also waste reduction, reuse, composting) at the community level: National Recycling Coalition, Keep America Beautiful, National Waste & Recycling Association (NWRA), Solid Waste Association of North America (SWANA), Recycling Partnership. A 2014 NWRA national survey found that a third of Americans are not clear on what materials go in recycling bins and carts. Contaminating the recycle stream with items that don't belong there is a key issue that impacts the efficiency and effectiveness of local programs.

SWANA and NWRA issued a joint advisory in 2015 around developing contracts for processing of municipal recyclables. The advisory acknowledges all of the issues discussed in this document. The advisory identifies the issue of "ownership" of the recyclables, which is relevant given the volatility of the market. If the municipality maintains ownership of the material, it "buys" that risk; however, the municipality could put in place a Recycling Reserve Fund that creates a stabilization fund that deals with the volatility. Excess revenue is deposited in the fund when the market is high and drawn upon when the market is down. The down side of the municipality owning the material is that it could reduce the contractor's incentive in doing its part to maintain the quality of the material (to avoid decline in revenue due to contamination, etc.). In July 2016, SWANA and NWRA released another statement with two addenda to the 2015 statement including added guidelines to help address challenges in the recycling market.

According to an April 2017 USA Today article, when cities launched recycling programs in the 1980s and 1990s, the theory was that the revenue from the recovered materials would offset the costs of collecting and separating the waste, but it hasn't worked out that way. The city of Napa, California, for example, gets back about 20 percent of the costs of collecting, sorting and shipping materials. However, there are avoided costs (or economic benefits) that are not

tied to the revenues from recycled materials: reducing the use and cost of landfills and reducing the need for harvesting virgin materials. The burden of paying for recycling falls on cities - or residents who pay for the trash service - because the U.S. has not followed the path of many European countries of requiring manufacturers to take responsibility for the disposal or recovery of their products and packaging.

[\(www.usatoday.com/story/news/politics/2017/04/20/weak-markets-make-consumers-wishful-recycling-big-problem/100654976/\)](http://www.usatoday.com/story/news/politics/2017/04/20/weak-markets-make-consumers-wishful-recycling-big-problem/100654976/)

No amount of creative financing will make up for the current cost recovery that some municipal recycling programs have (per the Napa example). There has to be a consumer behavior shift. As a society we think "out of sight, out of mind," and we take materials & waste disposal mostly for granted, just like we do our water and air. For lasting solutions, we need to quantify the true cost of waste management more accurately, and incentivize waste reduction activities in proportion to their value - which means disaggregating how we think about waste and materials. When people start paying the true cost for disposal of each material, they will think more carefully about consumption. The more clearly people see what they are paying for, the more they feel empowered to figure out ways of reducing that activity.

New Ideas in the Marketplace

There are a variety of different advocacy organizations and enterprises active in changing the paradigm of the recycling space. Three organizations listed below are examples of alternate and/or new sources of funding:

- Closed Loop Fund is an impact fund investing \$100 million to increase the recycling of products and packaging. Their stated goals are to eliminate more than 50 million tons of CO2 emissions, divert more than 20 million tons of waste from landfills (cumulative), and create more than 20,000 local jobs across the country, save more than \$1.2 billion for U.S. cities, and prove a replicable model that will help unlock additional investment in recycling by 2025. They provide zero percent interest loans to cities and below-market rate loans to private companies for recycling infrastructure. Their stated investment categories are for expanding curbside programs, facilities and technologies for sorting single stream materials, and proving end uses for film, flexible packaging, and glass. Recent Fund investments in Memphis saved nearly \$200,000 in less than a year by expanding curbside recycling collection to more than 100,000 households; investments in Lakeshore Recycling in Chicago diverted 100,000 tons of material in 18 months, reducing 250,000 metric tons of CO2 emissions. Closed Loop Ventures invests in sustainable consumer goods, advanced recycling technologies, and services related to the circular economy. Closed Loop Foundation funds research and development on technologies and business models focused on building the circular economy (see closedloopfund.com).

- The Recycling Partnership, a non-profit founded in 2003, is focused on improving residential recycling in the U.S. They specifically target improving curbside-based recycling efforts. The Recycling Partnership provides grants for curbside carts, educational support, and technical assistance. (see recyclingpartnership.org)
- Recycle Bank is a non-profit that creates reward programs for individuals that are saving energy, recycling, and conserving natural resources. The program was started in 2004, focusing on creating waste-free communities. Their rewards come in a variety of forms such as products, coupons, and discounts from lead brands. They also provide the option of donating rewards to support environmental education in schools. Their process allows individuals to set a target (such as recycling) and then provide reward points based on documentation of the activity. The recycling activity includes home-generated materials along with e-waste. (see recyclebank.com)

Working Group Brainstorming

In response to EPA's Charge, EFAB organized a working group to focus on the questions posed. The group was comprised of both board members and staff from several Environmental Finance Centers. During multiple phone calls and in-person meetings, the working group concluded that: there are no magic financing solutions that can overcome significant fluctuations in commodity prices, although there may be technology innovations that can lower the barriers to entry for certain materials; and location is a major hurdle for infrastructure investments.

Taking into consideration the challenges and trends outlined above, the working group developed several categories of innovative financial mechanisms that we feel are needed to address the changing market place. Key categories of financial mechanisms and strategies include:

- Sources of capital to implement technology changes
- Robust and resilient revenue models that produce sufficient revenue to support capital investments and recurring operating costs
- User fees and taxes that support revenue models; reallocating cost and/or payment responsibilities among market participants
- Contracting mechanisms to address changing revenue models and changing conditions
- Pooling and aggregation methods. Some innovation results in strategies that pool larger groups of beneficiaries (or generators) together for both cost reduction and revenue raising purposes.
- Perspectives relative to customer financial incentives (e.g., "free recycling" while a

noteworthy incentive leads to a difficult revenue proposition)

- New or expanded allocation of payment responsibility among different market participants (producers, users, general government)

The working group also prepared an inventory of financial mechanisms that fit in to one or more of the categories above. Existing financing ideas being implemented today include:

- Zero interest loans from organizations such as Closed Loop Funding (different source of capital) or technology/business model investments from organizations such as Closed Loop Ventures or Foundation
- Tax-exempt solid waste revenue bond financing (although there is no minimum size requirement, qualified solid waste disposal project financing costs generally need to exceed \$4.0 million in order for the bond issue to be cost effective for the borrower)
- Grants or voluntary contributions (free funds from state pools or organizations such as Recycling Partnership)
- Venture Capital investments (see closedloopfund.com) for technology development
- P3 efforts (both the Closed Loop Fund and Recycling Partnership have private corporations as investors, while the Recycling Partnership markets itself as a Public-Private Partnership given its target market is cities; Walmart's incentive to participate in the Closed Loop Fund demonstrates that there is a value here for private participants to invest)
- Extended producer responsibility (take-back programs) via "recycling fee" placed on the product (such as paint or bottles) or a leasing arrangement for the product (such as leasing tires for vehicles rather than owning them)
- "Pay for Success" programs or sometimes referred to as Social Impact Bonds (similar to the DC Water Environmental Impact Bonds (there is an emerging market of parties looking for pay for success opportunities in areas where non-profit services are prevalent))

The working group considered the question: are there new/robust/resilient revenue models that produce sufficient revenue to support capital investments and recurring operating costs? "Robust and resilient" models will likely require a smoothing of the price volatility of recycled outputs, which has been a problem recently, with lower commodity prices making recycling less competitive. Can municipal recycling/waste management programs hedge future cost volatility with low-premium, deeply OTM commodity put options? Similar to fuel hedging, is there a market for instruments that would cap the cost for municipalities?

Pay-as-you-throw is a model that has to be executed carefully (see Seattle case study on evolution of a program). Charges must be high enough to actually cover costs; it might make sense to ensure fixed costs are covered by property or some other form of taxes, and variable costs are covered by user charges. User charges would need to be more for trash than for commingled recyclables, and more for commingled recyclables than for recyclables that the user sorts him/herself. People would need to be sufficiently discouraged from abusing the system by throwing trash into the recyclables to pay less, or from throwing commingled recyclables into the sorted recyclables. For that, consider fining consumers (fines would need to be high enough to dissuade people from cheating, but probably in proportion to the difference between the trash fee and the commingled recyclables fee and the threat of a fine has to be credible). Overall, the goal is maximizing the flow of pre-sorted recyclable materials.

Rather than using fines to incentivize proper consumer behavior, there could be a model based on an expanded allocation of payment responsibility among different market participants (producers, users, general government), where:

- Local/regional government completely covers the fixed costs of Municipal Solid Waste (MSW) through tax revenues. Running the landfill and Municipal Recycling Facility (MRF, also known as materials recovery facility) is a public good that is paid for per household.
- Users partially cover variable costs of MSW through variable-rate user fees (those who generate more waste and recycle less should pay more; those who sort more of their recycling should pay less than those who commingle it). The more effort the household takes on in reducing waste or simplifying recycling/waste streams, the greater the reward.
- Both producers and users cover the remainder of variable costs through sales taxes that are rebated and split between both producer and user/household when the material is returned to vendor at the end of its useful life. This is some form of shared Extended Producer/User Responsibility. Waste averted is waste that doesn't need to be processed.

Uncertainties Regarding Future Market Conditions

Although it is beyond the scope of this charge, the development, manufacturing, and reuse of readily recyclable products (circular economy) is the next generation in materials management. However, the circular economy solution is still years away from being a means of diverting recyclable materials from landfills.

Recycling can be reframed as a component of solid waste management rather than a separate service (see Oregon's 2050 Sustainable Materials Management Plan). Under existing market conditions, the diversion of recyclables from landfills often directly impacts the recyclable revenue markets. Too much supply can drive down prices. Goals for diversion often assume

that the market will resolve the problem. It is not clear if markets (local versus national versus international) can consider a more measured approach to diversion.

Absent regulations that ban recyclables in the garbage stream (which are difficult to enforce), recycling will not be universal and maximized. Even when the value of recycled materials is low, it is important to look at the avoided cost of landfilling the material along with long-term costs related to the environment.

A key action item, which is beyond the scope of this charge, is to reduce the technical costs of waste reduction and modernize the industry. Support can come in the form of lower cost capital as set forth by multiple players in the sector. However, in the absence of balancing the throughput, with the attendant swings in revenue and profitability, it can be difficult to repay these capital investments.

Generally, recycling and its pricing should be consistent with other utility services whereby consumers pay for what they use. While it will remain difficult to price recycling as a unique service with the costs fully recovered by a recycling fee, its role in the overall management of MSW, whether provided free or at a reduced cost to encourage maximum participation, is important to meet the goals communities have in place.

Findings

In reviewing various financing options, trends in the curbside recycling/landfill diversion programs, and the rising interest in circular economy options for a wide range of materials, the working group did not find straightforward recommendations to provide EPA management. Instead, the working group concludes that absent a shift in consumer/residential behaviors regarding desire for recycling efforts and programs or a shift in environmental policy and regulatory efforts that redirect both individual and community behaviors, the current lowest cost materials management solutions (i.e. landfilling) are difficult to overcome until we actually take into account externalities and full life cycle pricing when it comes to landfill disposal fees. Consumer behavior, as it pertains to recycling, is heavily driven by individual core values and priorities (in other words, "I recycle because it's the responsible thing to do"). There are examples of communities, such as Seattle (highlighted below) that have transitioned from low cost driven effort to a diverse program that is now embedded in the core values of the regional culture. It is our collective opinion that culture/core values and priorities/desire provide a basis to overcome some of the economic challenges faced by the various commodities, as well as the common challenge that it is "easy/cheap to throw things away". However, a regulatory mandate that is tied to a flexible recycling revenue/cost will often be an effective method of increasing program effectiveness.

Example Financing Programs

The following city, state, and private programs were identified by EFAB members as examples of the various options for funding curbside programs. There are several "pay as you throw" programs in place that incentivize recycling or maximize landfill diversion by placing high costs on garbage cans/materials sent to landfills.

Seattle

Seattle's Solid Waste Fund prices the separate elements of their full waste stream to maximize consumer incentive to recycle and reduce waste generation. Seattle does not charge for recycling; however, they have a variable rate fee for garbage, with very high rates that encourage recycling. Their organics rate (yard waste and food waste) is much lower than the garbage rate, which encourages organics recycling as well.

Residential collection rates for garbage is \$22.85 per month for a 12 gallon can, \$28 per month for a 20 gallon can, \$36.45 for a 32 gallon can, \$72.90 for a 64 gallon can and \$109.35 for a 96 gallon can (extra fees are paid for bags/amounts exceeding these limits). Food and yard waste is at a different rate structure: \$6.05 per month for a 13 gallon can, \$9.10 per month for a 32 gallon can, and \$11.65 per month for a 96 gallon can (extra fees apply for amounts exceeding these limits). According to the Seattle Public Utilities web site, the city currently recycles about 60 percent of its municipal solid waste and aims to recycle 70 percent by 2025. Seattle's rate structure leads to a robust and resilient revenue model that produces sufficient revenues to support investments and recurring operating costs (see <http://www.seattle.gov/Util/MyServices/Rates/RecyclingRates/index.htm>).

Moving to a variable rate structure has revenue risks in its own right, so care has to be taken to understand the waste stream, residential demands, etc. and make conservative assumptions regarding participation to ensure adequate revenues as the program is put in place. Other policies, such as weight limitations on containers, are also important. Seattle experienced the "Seattle Stomp" when they first put in place their system of charges, with residents compacting material into smaller containers so tightly that it was very difficult to remove from the containers, and unsafe for workers who were manually lifting the smaller containers. The instructions on the website are very clear for food waste - it either fits into the allotted can or is stored by the resident until the following month (your suggested option is to increase the size of the can and pay a higher monthly fee).

To assist residents on what is recyclable material and which can it goes into, the website has a "Where Does It Go" section that provides directions for the following materials: household items, construction and demolition debris, electronics, fabrics, food, food packaging, glass and ceramics, hazardous items, metal items, paper, plastic, vehicles, wood, and yard waste. For hazardous materials, there are special collection points; there is on-call curbside pickup for recyclable electronics, and vehicles/car parts go to scrap metal dealers. All of this information is intended to keep materials from the wrong location and achieve that 70 percent recycling goal.

Targeted Incentives in Phoenix

Phoenix has been working with grocery stores and restaurants to drive down the food waste component going to landfills, some of which is tied to the MRFs and diversion programs. The City has a target of 40 percent diversion by 2020 and zero waste by 2050. The Public Works Department provides a number of solid waste recycling/diversion programs in order to capture and divert as much material as possible to be reused, repurposed, or recycled. Similar to Seattle, the City provides information on what is recyclable and what is not. These programs include curbside green organics, household hazardous waste and electronics, composting, Christmas tree collection, electronic sign recycling, appliance recycling and pickup, cardboard, paper, plastics, metals, and glass (see <https://www.phoenix.gov/publicworks/recycling>).

One of their programs is to get residents to cut down on trash bags (going from 5 to 4 per week and using a smaller trash can) by giving them a \$3 reduction in the monthly trash fee (termed the reduce and recycle program). Green organics recycling is offered at a fee of \$5 per month. Solid waste fees are \$23.80 per month for a 60 gallon container and \$26.80 per month for a 90 gallon container.

September 2017 information (Arizona Republic, Sept 13, 2017 article) indicates that the green waste recycling efforts are suffering due to poor participation in the curbside recycling program. Fewer than 4 percent of the 158,000 eligible properties are participating in the program, which allows residents to send green waste to a composting facility through a separate bin that the city collects weekly (the bin does require a fee). The curbside recycling of green waste is an important component of reaching the 40 percent diversion target for 2020, as the current rate is 20 percent (it was 16 percent in 2013).

Illinois Finance Authority - Tax-Exempt Solid Waste Revenue Bond Financing

Effective October 17, 2011, the IRS amended the Income Tax Regulations under section 142 of the Internal Revenue Code to provide final rules for determining whether a facility is a Solid Waste Disposal Facility under section 142(a)(6) of the Internal Revenue Code, as amended. There were 2 notable changes that helped enable conduit issuers finance solid waste recycling projects for the first time:

- First, the 2011 Bulletin removed the "No-Value" Test contained in the prior solid waste regulations which had generally limited tax-exempt Solid Waste Disposal Revenue Bonds to situations in which the solid waste had no value (or negative value).
- Secondly, the 2011 Treasury Regulations added Recycling Processes to the two existing qualified Solid Waste Disposal processes (i.e., (i) Final Disposal Processes (landfilling or incineration) and (ii) Energy Conversion Processes (i.e., using solid waste to create useful energy).

The 2011 Treasury Regulations defined "Qualified Recycling Processes" as those involved in converting solid waste into a useful product through a process (e.g., decontamination, melting, re-pulping, shredding, or other process) with the qualified solid waste disposal activity ending with a first useful product. The "First Useful Product Rule" with respect to a recycling process provides that the qualified process (for tax-exempt bond financing) ends at the point the first product is produced from the solid waste processing that is useful for consumption in agriculture, consumer or commercial products, or governmental or industrial operations. Specific examples include:

- Paper recycling
- Plastic recycling
- Tire recycling
- Metals recycling
- Waste electronics recycling (but not refurbishment, which would constitute re-manufacturing)
- Other Solid Waste recycling activities
- In addition to the core recycling facilities, the Internal Revenue Code also authorizes the following facilities to be financed if integrated and essential to the core recycling process: (1) "Preliminary Facilities" (which collect, separate, store, treat, process, disassemble, or handle solid waste) and (2) "Functionally Related and Subordinate Facilities" (i.e., any land, building, or other property functionally related to the solid waste disposal and recycling activities).

The Illinois Finance Authority (IFA) issued \$10.9 million of Solid Waste Disposal Revenue Bonds that financed the acquisition of a building and the purchase and installation of recycling equipment for use therein. The total project cost was \$13 million. In addition to qualified recycling activities, the Company also had a component rebuilding division located in a portion of the building (an activity that did not qualify for tax-exempt solid waste disposal revenue bond financing). Costs attributable to the rebuilding operation were excluded from the Solid Waste Disposal bond issue. The Borrower obtained a bank financing commitment while IFA conveyed tax-exempt status on the financing. The participating bank assumed 100 percent of the project/corporate default risk on the IFA bonds Oust as on a commercial loan). In 2016, the Iowa Finance Authority issued \$15 million in Solid Waste bonds for the construction and equipping of a facility to convert food waste into a livestock feed ingredient. (See <http://www.il-fa.com/programs/community>; and see Local Government Revenue Bond Summary.)

Ecomaine: A Successful Regional Model

Ecomaine has the largest municipal recycling program in the state of Maine and is the largest publically owned and operated integrated waste management service in New England. Solid

waste disposal, single sort recycling, and most recently food scraps recovery, are provided by this non-profit organization owned by 20 member municipalities in southern Maine and which serves an additional 52 communities on a contract basis. Ecomaine prioritizes its functions and services according to Maine's Solid Waste Management Hierarchy, which is: reduction of waste generated, reuse of waste resources, recycling, composting or digesting of food or other biodegradable organic waste, waste-to-energy, and, as a very last resort, landfilling.

Ecomaine is a good example of a financial mechanism innovation by pooling large numbers of solid waste generators together for both cost reduction and revenue raising purposes. Cash is generated from tipping fees (the largest source of funding), and from the sale of recycled materials (which is a volatile market), and from the sale of electricity from the waste-to-energy plant. Ecomaine insulates their member and contract municipalities from recycling market fluctuations through a policy approved by the Board, of holding cash reserves that are generated by operations. Ecomaine has a budget surplus in most years that serves as a reserve account for deficit years, when recycling markets are low. Member and contract municipalities prefer not to have fiscal volatility from year-to-year, and rely on Ecomaine to budget conservatively by holding cash reserves. This insulation from market volatility could not have been achieved by any one single municipality, and is a good example of the collective benefits of an integrated waste management model. Reserves held at Ecomaine are not subject to use for other purposes like they would in a municipal setting, where general funds are subject to use for other municipal expenses like schools, roads, snowplowing, etc. Because Ecomaine is a regional collective, it was able to pay off its original bond early and has economies of scale to set aside funds to invest for future capital needs.

Recycling is encouraged through market incentives such as no tipping fees for recyclables delivered to its automated sorting facility and by pay-per-bag policies for solid waste in some of the larger member communities. Pay-per-bag is a model that requires the use of a certain color trash bag that is priced at a high rate to incentivize recycling. Recycling is the cheaper alternative to paying for each bag of trash produced because Ecomaine does not charge tipping fees for recycling. This model also works well in communities that have automated collection systems like South Portland, Scarborough, and Saco.

Yard waste management is easy and cheap for Ecomaine, and because of the strong seasons, yard waste composting ceases during the winter months. Food composting is a new initiative that has a certain future in Maine, and Ecomaine is one of the largest players in pushing both policy and operations changes forward. After a thorough feasibility study regarding organic waste processing, Ecomaine has initiated a pilot program in a public-private partnership with Exeter Agri-Energy. Ecomaine sends food scraps collected in its member municipalities to Exeter Agri-Energy which uses anaerobic digestion to produce electricity as well as meet the waste disposal needs of Maine's largest dairy farm.

CalRecycle

Established in 2010, CalRecycle (The California Department of Resources Recycling and Recovery), which is under CalEPA (California Environmental Protection Agency), administers California's recycling programs, which are managed at the local level by cities and counties. With an annual budget of \$1.4 billion, CalEPA receives no money from California's tax dollar-supported General Fund. Instead, its budget comes from primarily from recycling and disposal fees. In addition to providing guidance to jurisdictions and businesses on recycling programs, one key function of CalRecycle is the awarding of loans and grants to both private and public entities to develop recycling programs that helps meet its state mandated recycling targets, including 75 percent waste diversion by 2020 ("AB 341").

One noteworthy program administered by CalRecycle is the Recycling Market Development Zones (RMDZ) Revolving Loan Program. By providing low-interest loans for the purchase of equipment and other related costs, the program aims to encourage manufacturers located in RMDZ jurisdictions to increase "their processing capabilities and create additional markets for recycled-content products". Borrowers have embraced this program to overcome barriers in obtaining long-term credit. Conventional lenders have largely been reluctant to finance recycling-based manufacturing because processes often rely upon unproven technologies. The rate for these loans is currently set at 4.0 percent and the term is either 10 years (if secured by business assets) or 15 years (if secured by real estate).

In addition to loans, RMDZ jurisdictions provide additional incentives-such as expedited permit processing, management and technical assistance, tax incentives, and access to other low interest loans-to assist participating manufacturers. Another feature of the program is "RecycleStore", which is a user-friendly database administered of products produced by manufacturers participating in the program. Importantly, CalRecycle provides additional resources to participating manufactures to stimulate markets for recyclables. The following is a list of sample offerings:

- CalRecycle Business Assistance and Resources
 - o Business Assistance
 - o Buy Recycled Program (California state procurement policy and program)
 - o Construction and Demolition Recycling
 - o Other grants and loans
 - o Green Building
 - o Market Development Resources
 - o Recycles-Content Product Manufacturers (RCPM) directory
- Other Business Programs and Resources
 - o Business Environmental Resource Center
 - o California Association for Local Economic Development

- o California Manufacturing Technology Consulting
- o California Resources and Training
- Events
- Custom Support

Since 1993, the program has financed 215 projects (or \$165 million in loans). Currently, about \$2.9 million is available and CalRecycle anticipates about \$7.9 million will be available for FY 2017-2018.

RMDZ administrators provided some lessons-learned comments that are relevant to the current state of recycling. For example, they currently see market challenges for glass recycling as it is currently cheaper to make glass out of virgin sand; woody biomass recycling has been historically propped up by subsidies that are no longer in place. Of note, RMDZ loans are few and far between as one administrator remarked that she only can recall one loan executed during the past ten years. Lastly, administrators feel that they do not have sufficient resources to publicize these loans (and to guide potential borrowers through the process) as the paperwork to apply for a RMDZ loan is significant and requires technical support.

Missouri Statewide Tipping Fee

Missouri charges a tipping fee on every ton received by landfills. The fee is divided between MDNR for solid waste permitting and planning activities, to the Environmental Improvement and Energy Resources Authority (EI ERA) for the development of markets for recycled materials and regional solid waste districts for solid waste planning and recycling grants-primarily for collection activities. The EI ERA provides funding to manufacturers for equipment that is used to make products out of recycled materials. The program identifies the wastes most problematic in the state and projects utilizing those waste streams receive weight in scoring. Currently the three targeted waste streams are plastics, organics (the most problematic waste stream which includes primarily yard and food waste) and construction/demolition waste.

Reframing Recycling: a Component of Solid Waste Management Versus a Separate Service

Many communities continue to separate recycling services from trash services in their fee structure; program design, and/or public information campaigns. Some communities have promoted recycling as "free" and stressed that a fee is only needed to cover trash pickup. Other communities have offered recycling as voluntary programs that customers can choose to subscribe to and pay an additional fee. Offering recycling programs as free have given some consumers the idea that the service itself does not incur significant costs. Offering it as a voluntary service suggests that it is not integrated into solid waste management. A North Carolina County recently had to discontinue their voluntary recycling program because not enough citizens chose the service. The County is currently studying options to revive the service and has realized that integrating recycling into solid waste service and charging a single solid

waste fee that covers both recycling and trash pickup would be much more financially sustainable. This is an example of changing how recycling is framed from being a separate service to being a component of solid waste management.

Closed Loop Partners

In a recently posted article, Closed Loop Partners articulated their vision for an enhanced circular economy by 2030 (<https://greenbiz.com/article/we-will-close-loop-waste-2030>). They argue that the development of circular supply chains, by closing the loop on consumer packaging and post-consumer waste at massive scale, is not only possible but that solutions already exist. They believe that the development of circular supply chains would provide annual savings to cities of more than \$20 billion, reduce greenhouse gas emissions by more than 500 million tons of CO₂ (equivalents), and drive revenues of more than \$500 Billion across multiple industries.

Closed Loop Partners sees investment opportunities in circular business models and have demonstrated that those investments can create market rate returns while also creating replicable solutions at scale. So far, a \$1 investment from Closed Loop Fund has attracted \$3 of co-investment from financial partners, including commercial lenders, municipal bonds, private equity, and impact investors. Closed Loop Partners has been conducting research on opportunities for recycling infrastructure and circular supply chain innovation to identify what is needed to drive a more circular system.

According to their work, solutions to closing the supplying chain loop are at various developmental stages and scale, requiring different types and levels of capital, including:

- Basic collection infrastructure or sorting capacity (typically financed with public or private debt)
- Emerging technologies, such as robotics, may require venture capital to commercialize, but may also need angel investments or philanthropy to get things off the ground
- Strategic capital for mergers/acquisitions/JVs could help push vertical integration as a way of overcoming industry short-comings

State of Oregon's 2050 Sustainable Materials Management Plan

Oregon's materials management approach includes waste prevention and discard management, while seeking to reduce environmental impacts by managing materials through all stages of their life. It identifies impacts and actions to address those impacts across the full cycle of materials and products as they move through the economy from raw material extraction to product design and manufacture, transport, consumption, use, reuse, recycling and disposal.

Oregon has an abundance of disposal capacity, in landfills that are better operated and less polluting than their predecessors. Recycling programs are firmly established, conserving resources, reducing pollution and providing green jobs. Some producers are sharing responsibility for managing their products at end-of-life and for reducing the presence of toxic chemicals in products that enter consumers' homes and eventually become solid waste. Recycling is now second nature for many Oregonians, and interest in "reduce" and "reuse" is growing.

Oregon's 2050 plan is based on the idea that smart decisions require thinking about impacts across the full life cycle of materials. Focusing on only management of discards limits options to protect the environment and can lead to decisions that are penny-wise but pound-foolish. In contrast, materials management offers a framework to address the integrated nature of materials, guide state policy and programs, and achieve the best results at the lowest cost to society.

Reframing Recycling Goals: Ideas from Waste Management

Recycling goals tend to be based on weight, rather than environmental outcome. Easy to divert recyclable materials represent 30-40 percent of the weight: paper, plastics, aluminum, glass, old corrugated containers. The harder to divert materials are typically organics that represent 20- 30 percent of the weight: food waste, yard/landscaping waste and debris, some compostable plastics. Then there is the challenging to divert materials that represents 10 percent of the weight: flexible packaging materials, small rigid objects. The rest of it that is another 20 percent of the weight: sanitary wastes, hazardous streams. So, these numbers suggest that 50 to 70 percent of the materials can be readily recycled with existing technologies and maybe 30 percent of the material cannot be recycled. The materials of the past, such as tin cans and glass jars or bottles, are being replaced with flexible packaging (primarily plastics) that increases the conveniences of the product. This change impacts the weight of waste materials and changes the net statistics of recycling (when done on a weight basis). The older, traditional materials have been used to develop the financial model of MRFs, while the newer plastics are either not collected curbside or are not recyclable. Instead of focusing on the amount of recycling, one idea suggested by Waste Management is to focus policies and programs on waste reduction first and then turn attention to improving recycling rates. Furthermore, Waste Management has done several presentations on product life cycle assessments that differentiate the effectiveness of recycling efforts based on the energy/carbon/water aspects of the materials, which can yield interesting results (such as demonstrating that a non-recyclable product could have a better life-cycle environmental footprint than a recycled material).

General Motors

There are examples of industrial practices that suggest circular economy thinking is possible for multiple products as a means of keeping residential-generated materials out of landfills. In some cases, manufacturers have taken efforts to reduce the costs needed to recover materials

or have prioritized using recycled raw materials in their products even if it resulted in slightly higher direct costs. For example, GM has partnered with multiple businesses to turn recycled plastic bottles sourced from Flint, Michigan into fleece, car parts, air filters, and even coats. The plastic bottles are sent to a business in North Carolina which produces dense plastic flake that can be used in textiles and yarns. The flake is sent to a Maryland-based company with a plant in North Carolina where it is turned into fleece which then goes to another company where it is turned into air filters and coats for the homeless. A full life-cycle cost analysis was needed to overcome the low prices offered from Asian plastic recycling centers (landfill disposal costs for the fiber scraps that became insulation for coats, lighter parts for cars increasing fuel efficiency).